

NOTES ON THE REPRODUCTIVE SYSTEM IN CTENOPHTHALMUS (SIPHONAPTERA: CTENOPHTHALMIDAE)^{1,2}

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ABSTRACT: The structures of the ovary and sperm of *Ctenophthalmus p. pseudagyrtus* were examined. The anatomy is compared with that of other fleas.

Descriptions of the anatomy of fleas are limited mostly to those species that are easily collected, commonly cultured, or are implicated in disease transmission. Much of the published information concerns species of the family Pulicidae. It is generally held that this is a very old family that diverged early from the rest of the Siphonaptera (Hopkins and Rothschild, 1953; Holland, 1964). Reports of the presence of nurse cells in the ovarioles of members of the hystrichopsyllid genera *Hystrichopsylla* (Hystrichopsyllidae) and *Stenoponia* (Ctenophthalmidae) (King and Teasley, 1980; Rothschild, Schlein and Ito, 1986) contradict the common assertion, based on data from pulicid species, that all fleas have panoistic ovarioles and have raised a question as to whether this condition may be widespread in members of the superfamily Hystrichopsylloidea.

Several reports on the ultrastructure of the spermatozoa of fleas have been published, but all these have been of pulicid species (Baccetti, 1968; Baccetti *et al.*, 1969 and 1971; Phillips, 1969; Rothschild, 1969; Rothschild, Ford and Hughes, 1970; Rothschild, Schlein and Ito, 1986). These sperm share several unusual features with those of Mecoptera. In both orders the outer ring of accessory tubules is lacking, the nine remaining outer tubules spiral around the central two, and the axoneme as a whole spirals around the elongate central paracrystalline core. It was thought worthwhile to investigate the structure of the sperm of a nonpulicid species to determine if there are any significant differences between fleas in these two main divisions of the order.

Specimens of *Ctenophthalmus pseudagyrtus pseudagyrtus* Baker (Ctenophthalmidae) were collected from *Microtus pennsylvanicus* in Ames, Iowa, in March 1986. Specimens were dissected in 2.5% glutaraldehyde and 2% paraformaldehyde in 0.1 M phosphate buffer, pH 7.3, and the tissues left in the fixative for 1-2 hrs. After washing in buffer and postfixation in osmium tetroxide for 1 hour the tissues were dehydrated in a

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graded ethanol series and embedded in Medcast[®] resin. Thick sections were cut on glass knives and stained with toluidine blue. Thin sections were cut with a diamond knife, stained with uranyl acetate and lead citrate, and viewed with a Hitachi HU11E-1 electron microscope operated at 50KV.

Serial sections of the ovaries clearly show them to be panoistic (Figure 1). King and Teasley (1980) have suggested that the nurse cells found in *Stenoponia* may not in fact be derived in the same manner as nurse cells in other insect orders. It was hoped that some intermediate condition might be

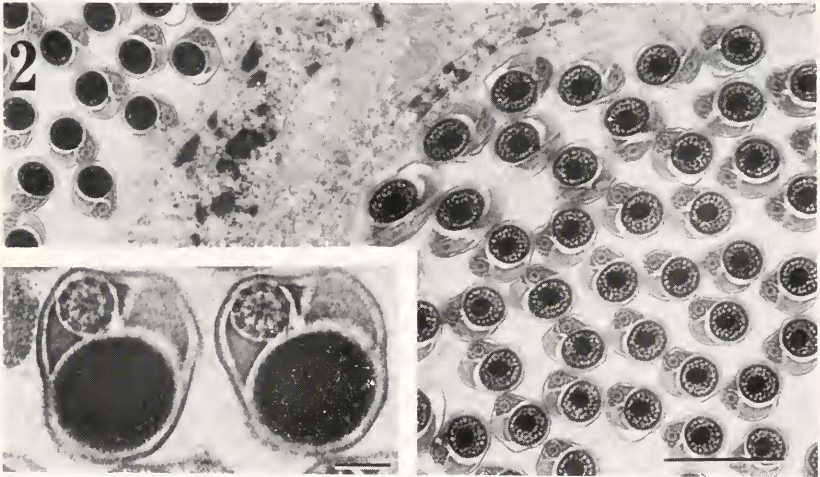
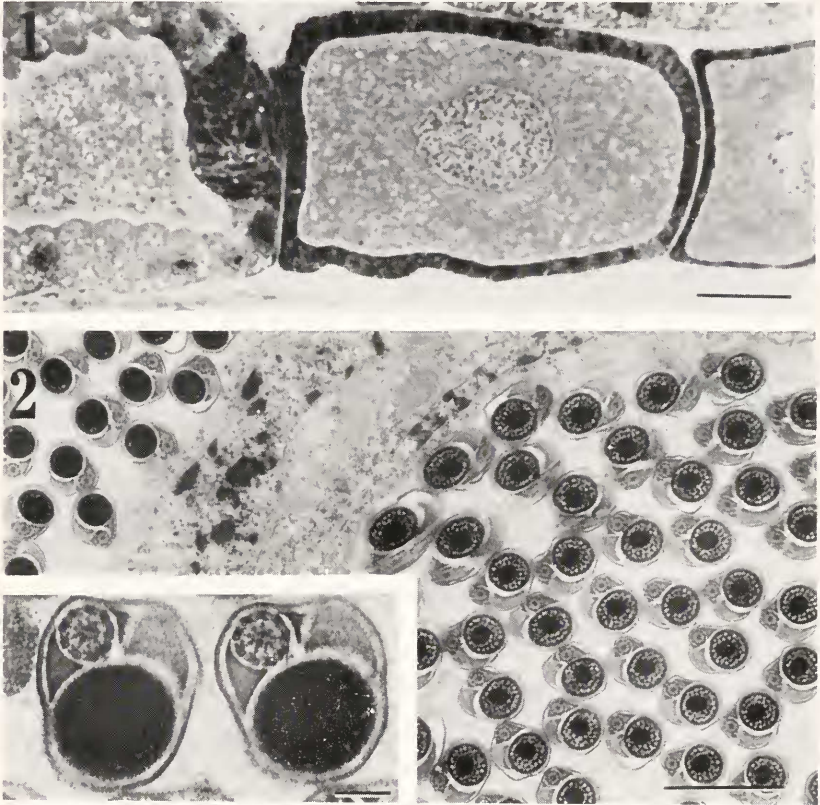


Figure 1: Longitudinal section through ovariole of *Ctenophthalmus p. pseudagyrtes*. Portions of three developing oocytes are visible. The oldest is to the left. Dark tissue surrounding oocyte is follicular epithelium. Line scale = 0.02 mm.

Figure 2: Transverse section through testis of *C. p. pseudagyrtes* showing sections through sperm tails at two different levels. Line scale = 2 μ .

Inset: Higher magnification of sperm tails at level seen in upper left of Fig. 2. Wheel-like structures are axonemes, dark body is mitochondrial derivative. Scale line = 0.2 μ .

found in *Ctenophthalmus* that would indicate the nature of the nurse cells in *Stenoponia*, but such is not the case. *Ctenophthalmus* and *Stenoponia* are members of different subfamilies within the Ctenophthalmidae, and the question of the frequency of occurrence of polytrophic ovarioles in this family, and indeed in other families of fleas, remains open. However, it is now known not to be universal within the hystrichopsyllid families.

Transverse sections through the tails of the mature spermatozoa of *C. p. pseudagyrtus* are illustrated in Figure 2 and the inset. Longitudinal sections as well as transverse sections at various levels of the sperm were examined. Although no attempt was made to systematically trace the structure of the entire sperm, the sections seen do reveal most of the anatomy, and it is so nearly identical in form to that of pulicid fleas as illustrated in the literature as to be indistinguishable. Any differences that might be found are expected to be insignificant. For detailed explanation of flea sperm structure the reader is referred especially to Baccetti (1968), Baccetti *et al.* (1969) and Phillips (1969).

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